HEIDENHAIN
DR. JOHANNES HEIDENHAIN GmbH
D-8225 Traunreut · Tel. (08669) 31-0

Kundendienst

Service Manual
TNC 113

Changes/Developments
We are constantly working on technical improvements of our products.
For this reason, details described in this manual may differ slightly from your control. In such cases, please order a revised service manual from us.

Duplication
This manual is provided subject to the condition that no part of it shall be duplicated in any form without our express consent.

Issue KD 2/93

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How to Use This Service Manual

The ServiceManual TNC 113 can be used to **diagnose** and **locate** errors on machine tools controlled by a TNC. It comprises **exchange instructions** that are important if a defect has occurred.

In order to correctly judge problems in an NC-controlled machine tool, fundamental knowledge of the machine, its drives and their interaction with the control and the measuring systems are required.

Incorrect behavior of the machine tool can also result from improper use of the control, NC-programming errors and incorrect machine parameters.

For information on

.**Operation**
.**Operating Modes**
.**Positioning**
.**Electrical Connection and Commissioning**

please see the Operating Manual TNC 113

In case of problems regarding the **interface** of the control to the machine tool, the **machine parameters** or the setting of the internal **DIL-switches**, please contact your **machine tool manufacturer.**

Support will, however, also be provided by the service department of **HEIDENHAIN Traunreut** or of the **HEIDENHAIN agencies.**
Telephone numbers, addresses and FAX-numbers can be found on the back side of this service manual.

1. Safety Precautions

Power Connection

Personal injury may result, if the grounded lead is interrupted inside or outside the control, or if the grounded lead connector is disengaged. Intentional interruption is not permissible.

Inputs and Outputs of the Control

Connect the inputs and outputs of the control only to circuits whose voltage is generated according to VDE 0100/5.73 § (protective low voltage).

Do not engage/disengage any connectors while the control is under power.

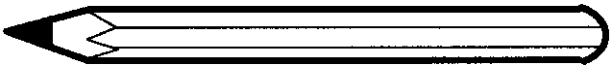
Internal DIL-Switches

Only the machine tool manufacturer may set the internal DIL switches, as incorrect settings may cause severe damage to the machine.

Machine Parameters

The machine parameter values may only be changed by the machine tool manufacturer!

Notes



2. Error Diagnosis

The TNC 113 features a comprehensive **integrated error monitoring system** for the **detection of technical defects**

. in the control electronics
. at the encoders
. during positioning

and to **avoid input and operator errors**.

After switching on the control, a **test program** is run automatically.
Certain parts of the control electronics, the encoders and the positioning are **permanently monitored** during operation.

2.1 Test Program

In the test program (duration approx. 5 seconds) the following functions are tested:

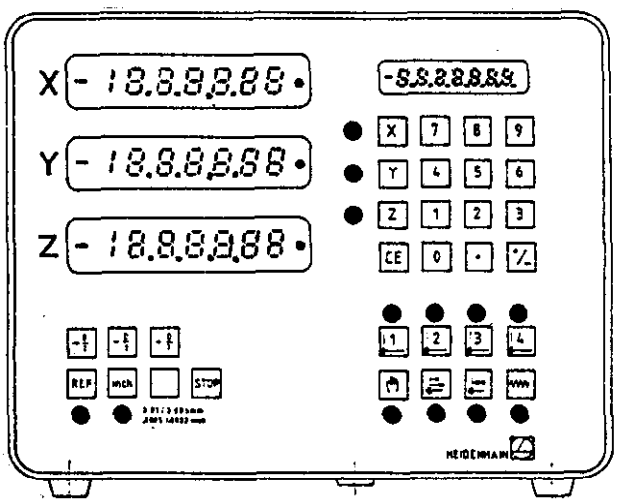
. Displays of actl. value and input value:	(display board)
. LEDs	(display board)
. EPROM	(display board)
. RAM	(display board)
. TIMER	(analog board)

Test: Actl. value display, input value display, LEDs

after approx. 2 sec.
duration approx. 3 sec.

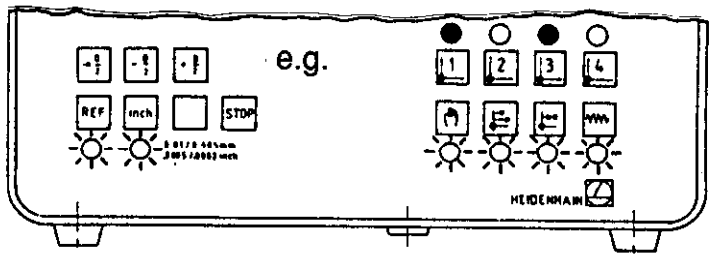
Visual Check:
. all segments of the actual value display and the input value display must be lit with the same light intensity.
. All decimal points of the input value display must be lit.
The decimal points of the actual value display are lit from the second decade on.
. All LEDs are lit.

actl. value display input value display



If an error is detected during the visual check, the complete control must be sent to us for repair!

If an error is detected, the lower row of LEDs blinks.
Moreover, an error code is displayed by the LEDs of the referece point keys.



The following error codes are possible:

	1	2	3	4
ROM- error (display board)	●	○	○	○
RAM- error (display board)	○	●	○	○
TIMER-error (analog board)	○	○	●	○
TIMER-error (analog board)	●	○	●	○
TIMER-error (analog board)	○	●	●	○
TIMER-error (analog board)	●	●	●	○
TIMER-error (analog board)	○	○	○	●
TIMER-error (analog board)	●	○	○	●

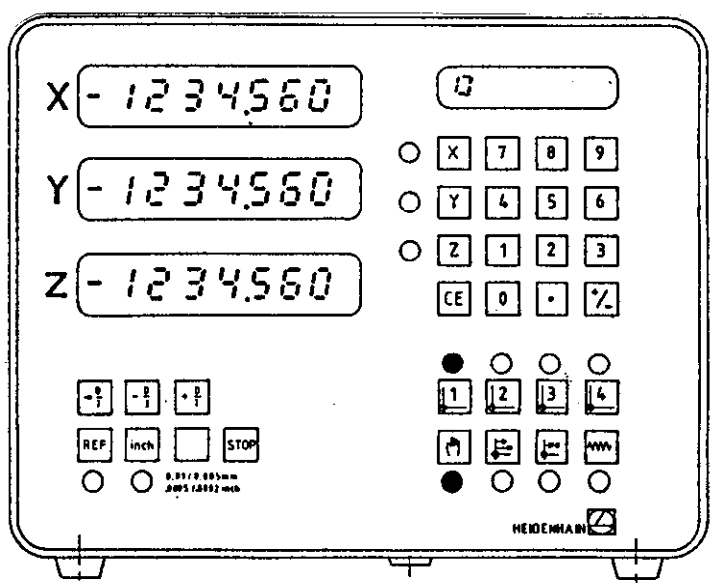
If the same error code is generated repeatedly, even if the control is switched off and on several times, the complete control must be sent to us for repair. Please indicate the error code.

after approx. 5 sec.

After the test program has been run without any error occuring, the TNC 113 switches to its "normal" operating state i.e.:

. the preset values are displayed in the actual value displays, "0" is displayed in the input value display.

. the LEDs of the keys [1] and [hand] are lit.

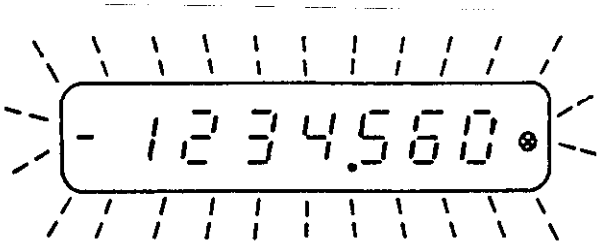


2.2 Error Messages of the Integrated Monitoring Systems and their Causes

In case of **failure**, the TNC 113 automatically generates **error messages** while opening the **contact "Servo Drive Release"** (to stop the machine).

2.2.1 Defective Measuring System

Failure of a measuring system is indicated by blinking of the actual value display of the corresponding axis.

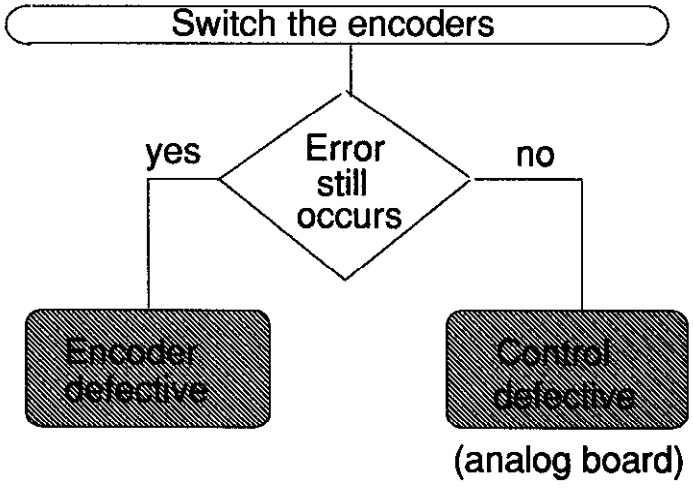


Switch off power, eliminate error* , switch on power again.

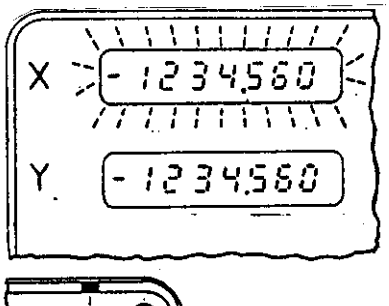
***Possible Error Causes:**

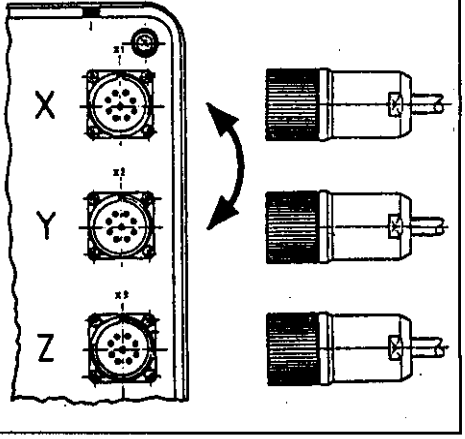
. Glass scale / steel scale contaminated or damaged
. Scanning unit contaminated or defective
. Cable damaged (short circuit / interruption)
. Encoder input of control defective (analog board)

Encoder Check



e.g.





Do not engage or disengage any connectors while the control is under power!

2.2.2 Defective Control Electronics

See "Test Program" sec. 2.1 page 2. Test EPROM, RAM, TIMER

2.2.3 Positioning Errors

Direction Monitoring ⇒ ∪∪∪∪∪∪∪∪

If the clutch lever of the machine is moved to the wrong position for the selected positioning direction, the feed is switched off after a traverse of 205 µm. ∪-shaped symbols are displayed for the input value.

press CE .
switch coupling lever to the correct position and restart positioning.

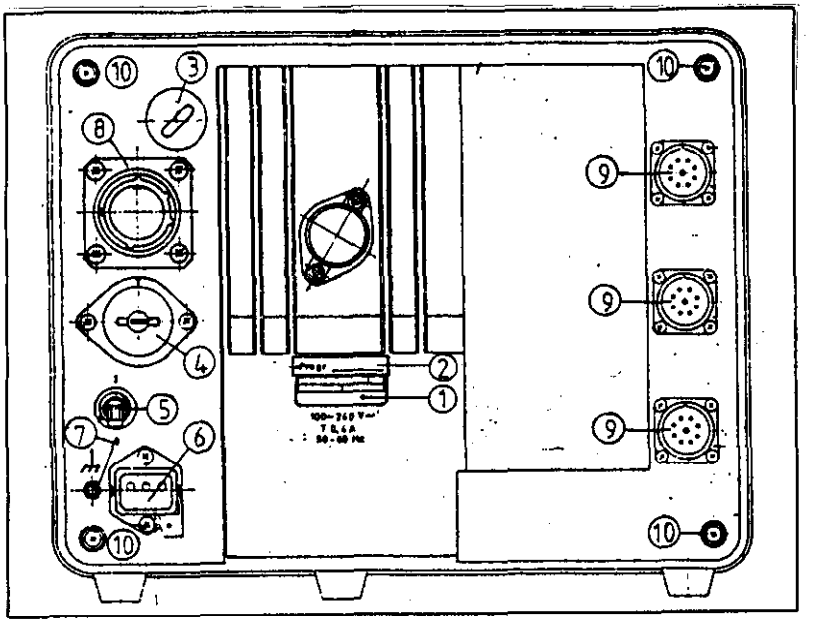
Standstill Monitoring ⇒ ∪∪∪∪∪∪∪∪

If a non-controlled axis is moved by more than 205 µm, ∪-shaped symbols are displayed for the input value.

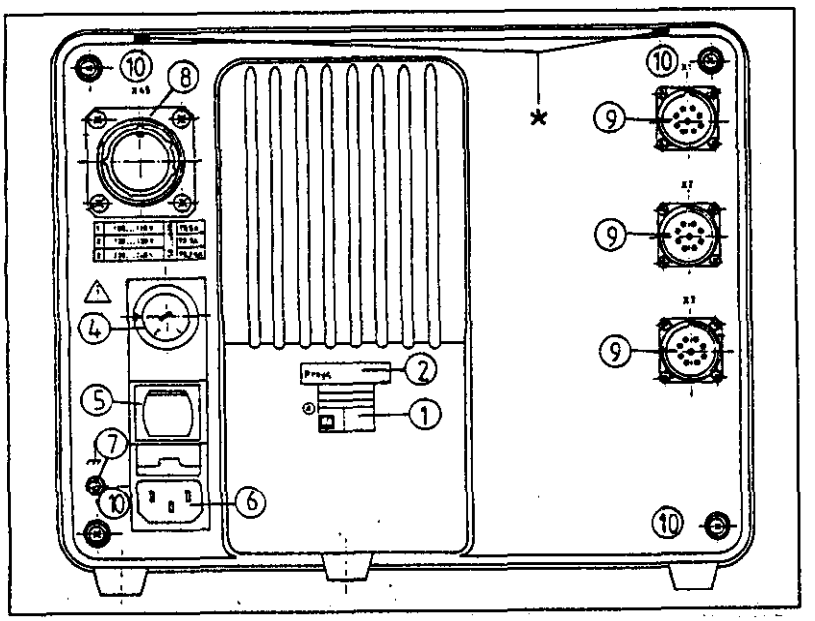
press CE .
check axis locking.

Notes

3. Instructions for Exchanging Components



TNC 113 Id.No. 216 130 01
TNC 113 Id.No. 216 130 03
TNC 113 B Id.No. 233 205 01

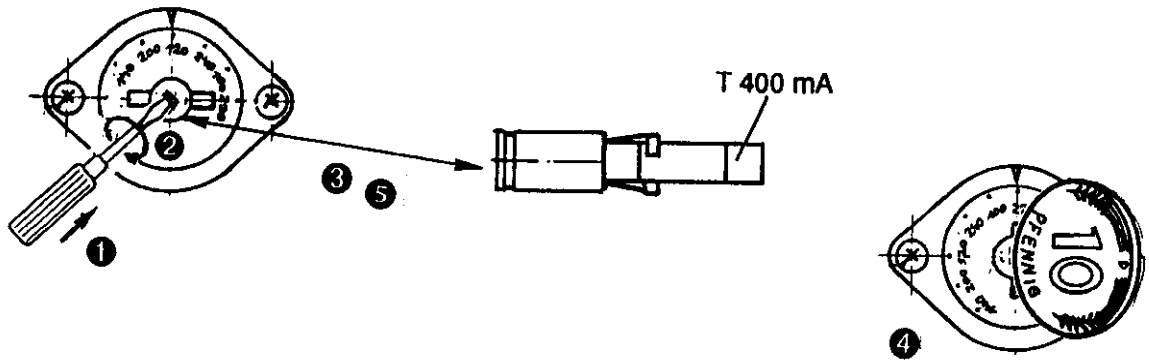


TNC 113 Id.No. 216 130 10
TNC 113 Id.No. 216 130 13
TNC 113 Id.No. 216 130 15
TNC 113 Id.No. 216 130 23 *

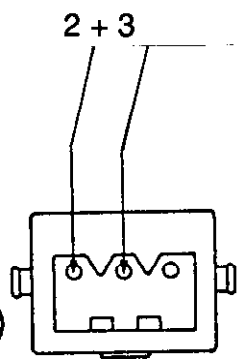
① Id. label
② program label (NC-software number)
③ dummy plug PG 16 (4 DIL switches)
④ line voltage selector
⑤ power switch
⑥ socket for power connection
⑦ grounding terminal
⑧ female flange socket, 22-pin (nom. value output, trigger signal outputs)
⑨ female flange socket, 9-pin (encoder inputs)
⑩ fixing screws

3.1 Power Supply

Old housing (see versions overview, section 4.7, page 1)

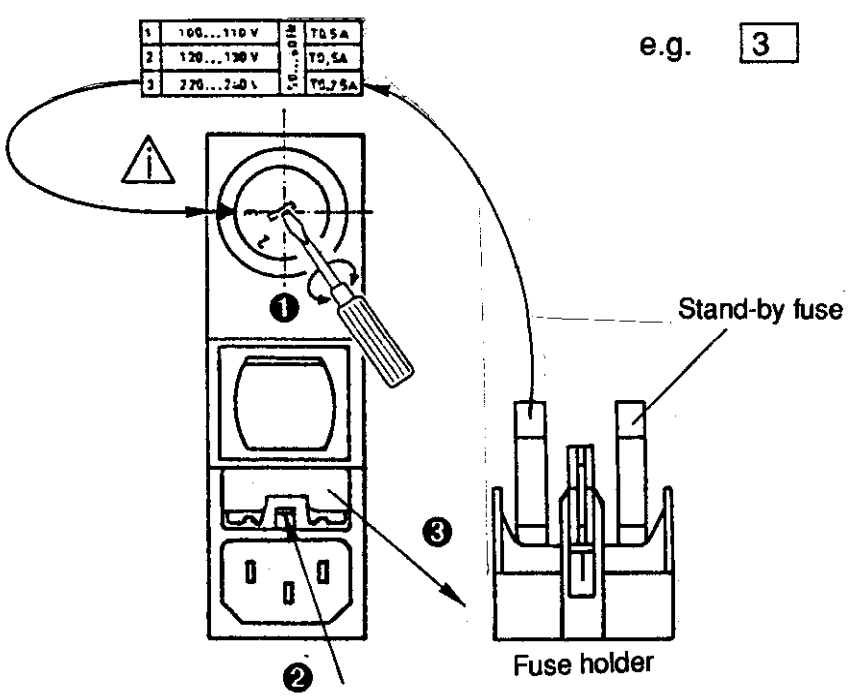


Power connection at terminals



Protective ground on ⏚

New housing (see versions overview, section 4.7, page 1)



3.2 Dismantling the TNC

Model

Id.No.

Serial No.

Progr. No.

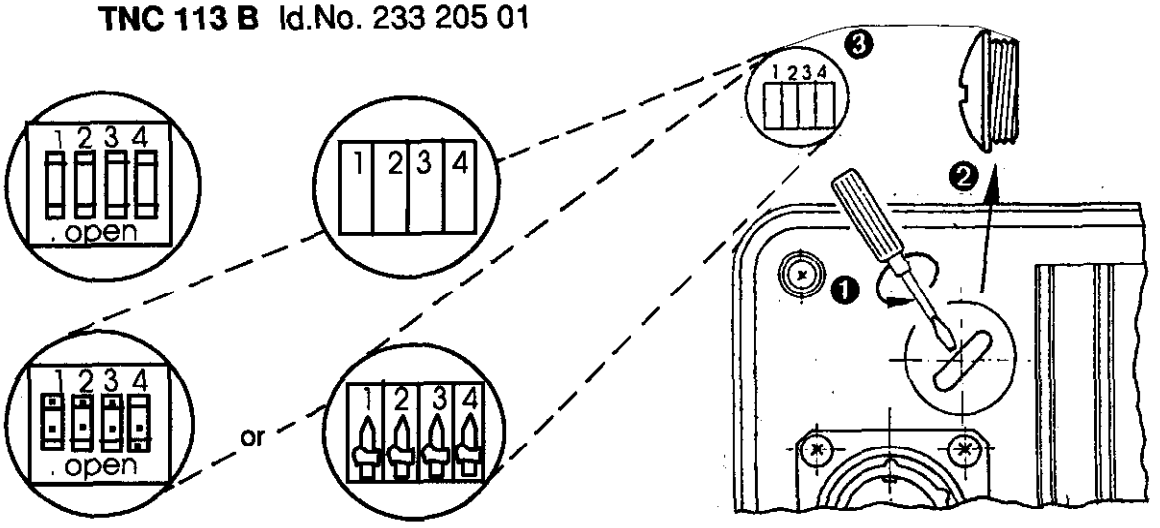
e.g.

Model	TNC 113
Id.No.	216 130 10
S.No.	4 281 662 A

M8

Progr. 216 916 03

Only with **TNC 113** Id.No. 216 130 01
TNC 113 Id.No. 216 130 03
TNC 113 B Id.No. 233 205 01



Only with TNC 113 Id.No. 216 130 10
TNC 113 Id.No. 216 130 13
TNC 113 Id.No. 216 130 15
TNC 113 Id.Nr. 216 130 23

MP 1.1 P 1.1

MP 1.2 P 1.2

MP 1.3 P 1.3

MP 2 P 2

MP 3 P 3

CE + 1 ⇒ e.g. P 1.1 0

Y ⇒ e.g. P 1.2 0

Z ⇒e.g. P 1.3 0

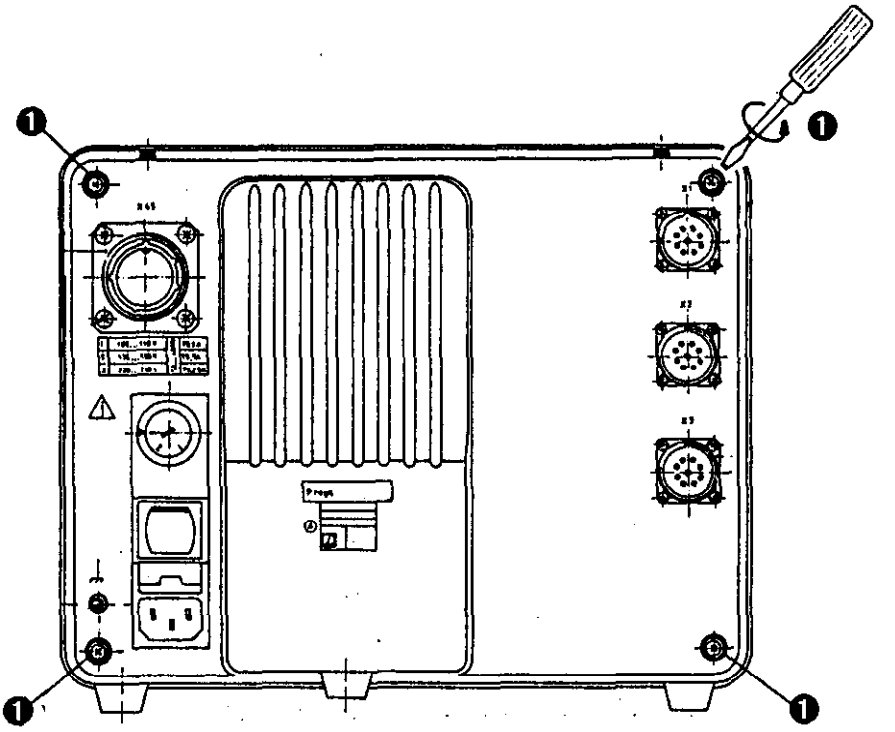
CE

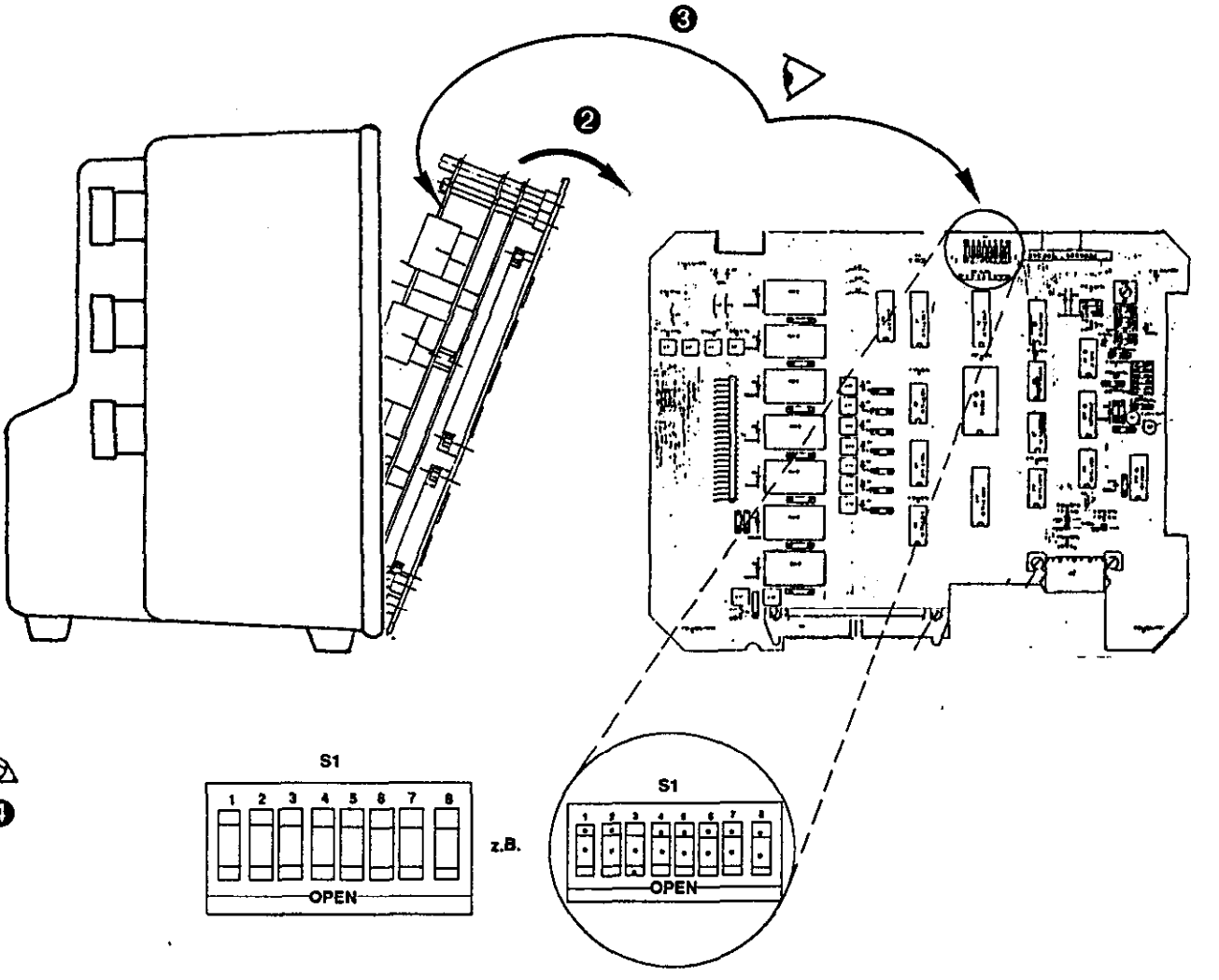
CE + 2 ⇒ e.g. P 2 1

CE

CE + 3 ⇒ e.g. P 3 0

CE




S1
1 2 3 4 5 6 7 8
OPEN
z.B.
S1
OPEN

3.3 Installing the TNC 113

Model	TNC 113	1)
Id.-No.	216 130 10	2)
S.-No.	4 281 662 A	M8

?

≡

Model	TNC 113	1)
Id.No.	216 130 10	2)
Serial No.	5 136 722 B	M12
Progr. No.	216 916 01	3)

Progr.216 916 03 3)

1) and 2) must be identical

3) The first 6 positions of the Id.No. (e.g. 216 916 ..) must be identical.
The version (e.g. 03) of the exchange unit may be higher than that of the original unit (e.g. 01).

Only for TNC 113, Id.No. 216 130 versions 10, 13, 15, 23

CE + 1	⇨ e.g.	P 1.1 0	(MP 1.1: counting direction x)
+/-	⇨	P 1.1 1	(0 → positive, 1 → negative)
✋	⇨	0	(storage of programmed value)
CE + 1	⇨ e.g.	P 1.1 1	
Y	⇨ e.g.	P 1.2 0	(MP 1.2: counting direction Y)
+/- / ✋	⇨	change / storage	
CE + 1	⇨ e.g.	}	(MP 1.3: counting direction Z)
Z	⇨	⇨ as x-/y-axes	
+/- / ✋	⇨		
CE + 2	⇨ e.g.	P 2 1	(MP 2: Y-axis as position display)
+/-	⇨	P2 0	(0 → axis controlled, 1 → position display)
✋	⇨	0	(storage of programmed value)
CE + 3	⇨ e.g.	P3 0	(multipoint error compensation X-axis)
+/-	⇨	P3 1	(0 → no comp., 1 → comp. 50µm/m)
✋	⇨		(storage of programmed value)

4. Appendix

4.1 Internal DIL switches

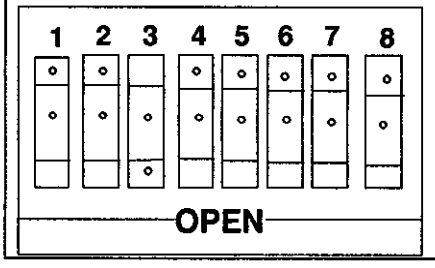
The internal DIL switches are located on the analog output board. By setting these DIL switches, the machine-tool manufacturer can define the positioning behaviour of the machine tool.

The DIL switches may only be set by the machine tool manufacturer, as incorrect settings may cause servere damage to the machine tool.

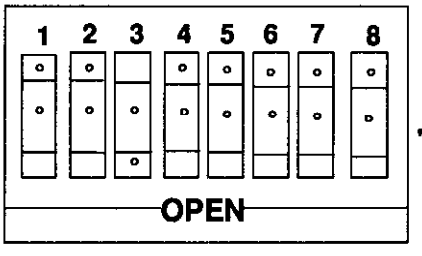
TNC 113 Id.No. 216 130 01
TNC 113 Id.No. 216 130 03
TNC 113 B Id.No. 233 205 01

TNC 113 Id.No. 216 130 10
TNC 113 Id.No. 216 130 13
TNC 113 Id.No. 216 130 15
TNC 113 Id.No. 216 130 23

Analog Output Board, Id.No. 215 847 01



Analog Output Board, Id.No. 261 036 01

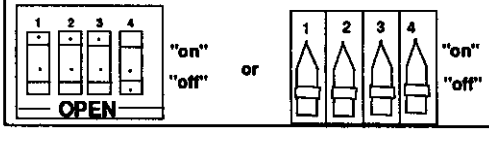


Software 212 916 --

DIL switch assignment (see also page 2)

1 no function
2, 3 } setting the characteristic of the positioning ramp (4 different ramp lengths)
4 as 246 040
5 as 246 040, but with 180 mV
6 as 246 040
7 no function
8 as 246 040

Power Supply Board, Id.No. 219 096 01



DIL switch assignment:
1 counting direction X
2 counting direction Y
3 counting direction Z
on: positive
off: negative
4 Y-axis as position display
on: axis controlled
off: axis as position display

Software 246 040 --

DIL switch assignment (see also page 2)

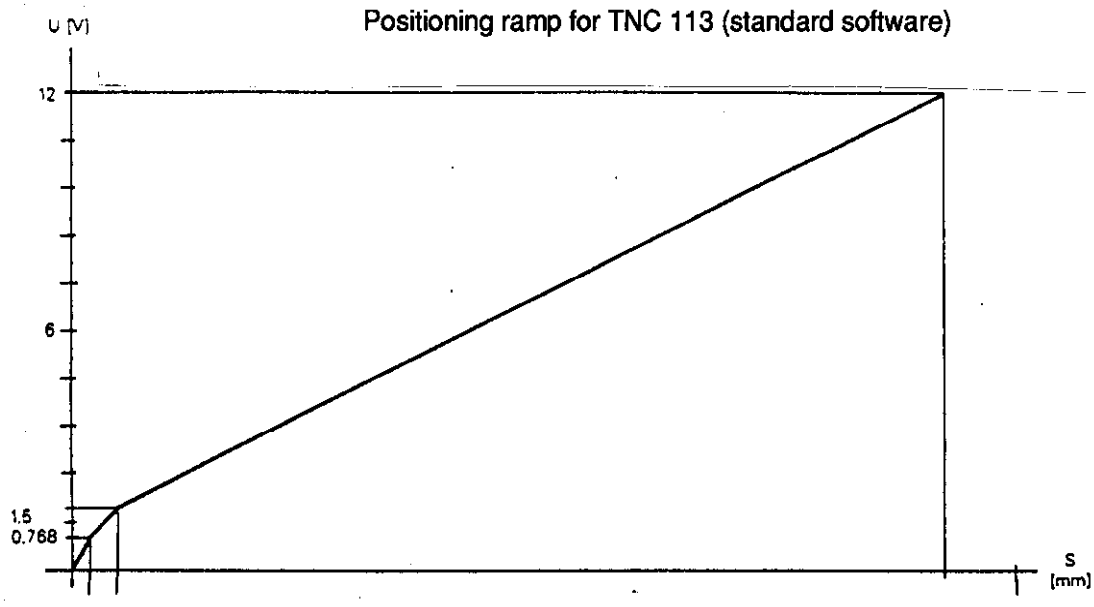
1 no function
2, 3 } setting the characteristic of the positioning ramp (4 different ramp lengths)
4 selection of analog output
on: unipolar
off: bipolar
5 starting voltage to start a positioning (300mV) for a traverse of 200 µm
on: with starting voltege
off: without starting voltage
6 waiting time before servo drive release
on: no waiting time
off: waiting time 150 ms
7 always set to "off" position
8 selection of the grating period
on: 40 µm
off: 20 µm

Software 246 088 --

DIL switch assignment:

as with software 246 040 --
The characteristics of the positioning ramps are 8 times as steep as those of the software 246 040 --.

4.1 Positioning Ramp Characterstic (Setting via DIL switches)



curve 1,	0.64	1.88	switches 2 and 3 on (DIL switches)	36.88 mm
curve 2,	0.32	0.94	switch 3 on	18.44 mm
curve 3,	0.16	0.47	switch 2 on	9.22 mm
curve 4,	0.08	0.23	switches 2 and 3 off	4.61 mm

Notes

4.2 Machine Parameters

Only for TNC 113	Id.No. 216 130 10	with Software 246 040 ..
	Id.No. 216 130 13	246 088 ..
	Id.No. 216 130 15	
	Id.No. 216 130 23	

The machine parameters are stored in non-volatile memory.

Parameters can only be entered/altered in the operating modes.

To call parameters

press the following keys simultaneously: CE and 1, X, Y, Z
2
3

To alter parameters press: +/-

To exit the parameter display without saving changes press CE

and save changes press

CE + 1 (X) ⇨ MP 1.1 counting direction X-axis
CE + 1 (Y) ⇨ MP 1.2 counting direction Y-axis
CE + 1 (Z) ⇨ MP 1.3 counting direction Z-axis

0 → positive
1 → negative

CE + 2 ⇨ MP 2 Y-axis is position display

0 → axis controlled
1 → position display

CE + 3 ⇨ MP 3 multipoint error compensation X-axis

0 → on
1 → off

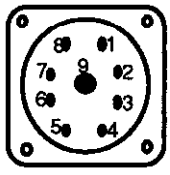
Value of multipoint error compensation: 50 µm/m

Counter display x 1.000050= compensated value

The machine parameters may only be altered by the machine tool manufacturer!

Pin Layout of the Flange Socket for Encoder Connection

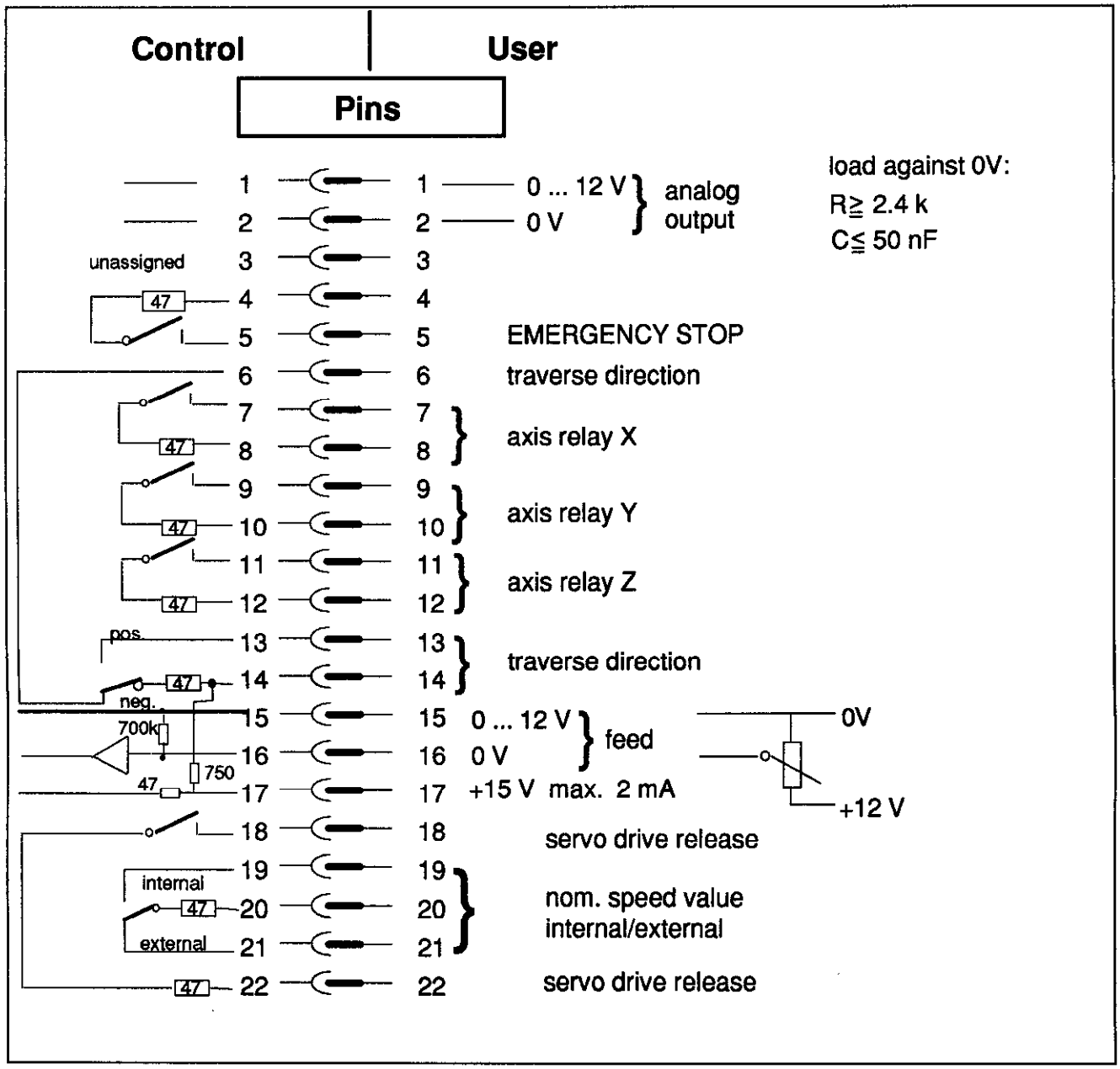
Flange socket

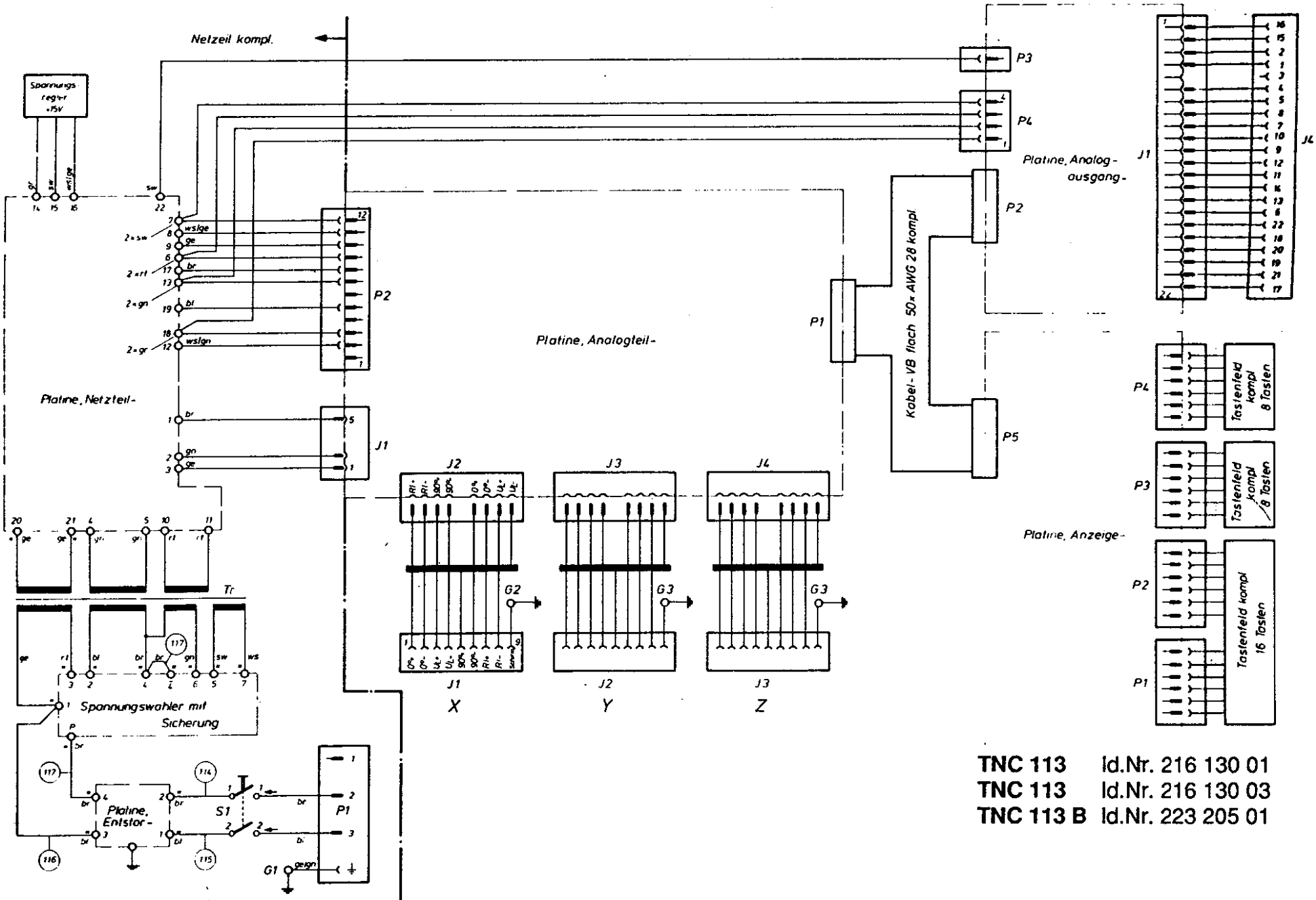


Pin	3	4	1	2	5	6	7	8	9*
	+	-	+	-	+	-	+	-	
Assignment	lamp U_I		output signal (0° el.) I_{e1}		output signal (90° el.) I_{e1}		ref. signal I_{e0}		shield
Input signals electr. values	+5V ± 5% approx. 120 mA		for HEIDENHAIN linear and rotary encoders without integrated pulse shaping electronics						

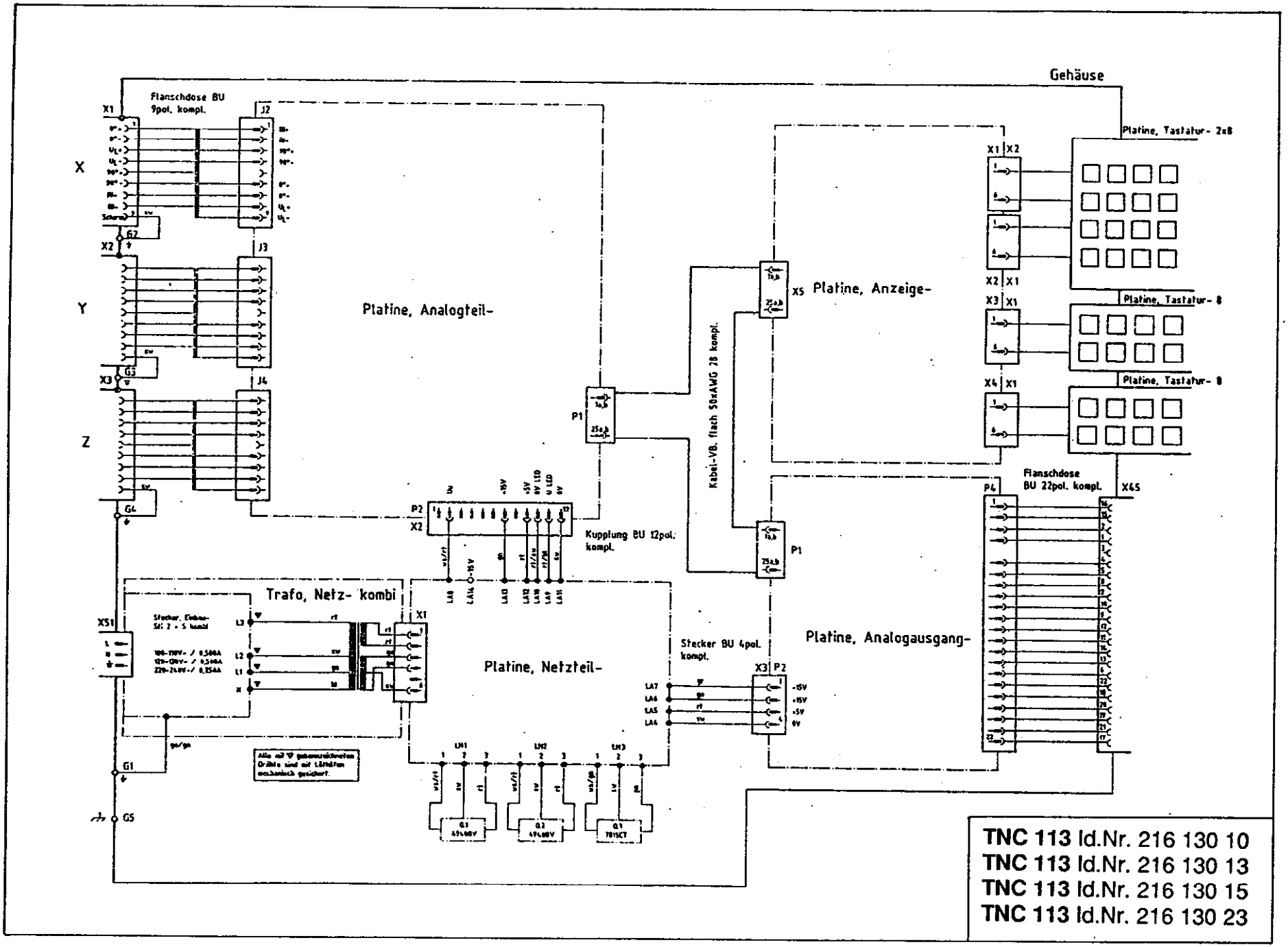
* Internal shield on pin 9
External shield on connector housing

Interface and Connector Layout

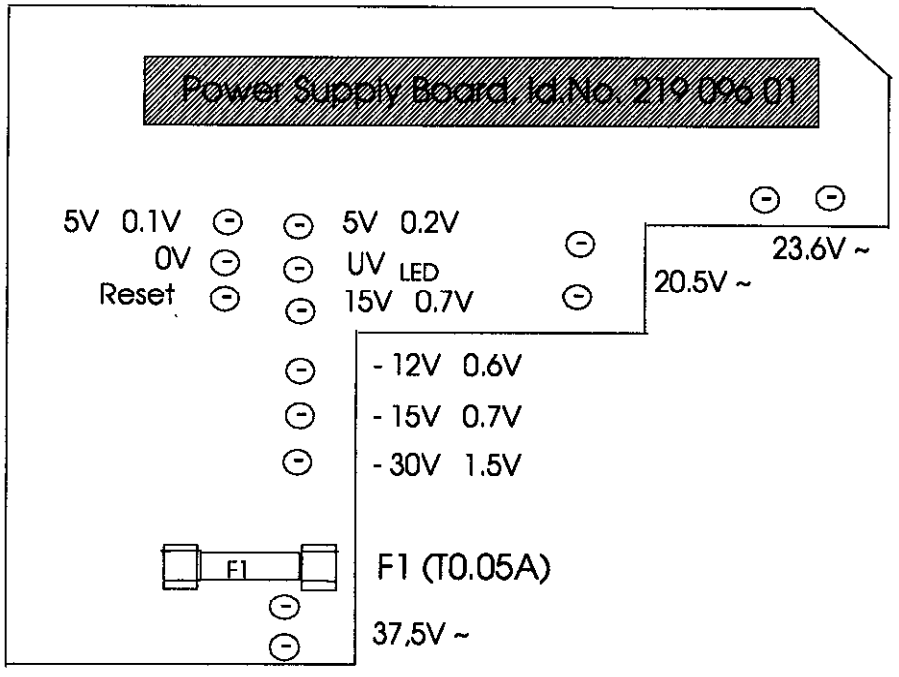




TNC 113 Id.Nr. 216 130 01
TNC 113 Id.Nr. 216 130 03
TNC 113 B Id.Nr. 223 205 01

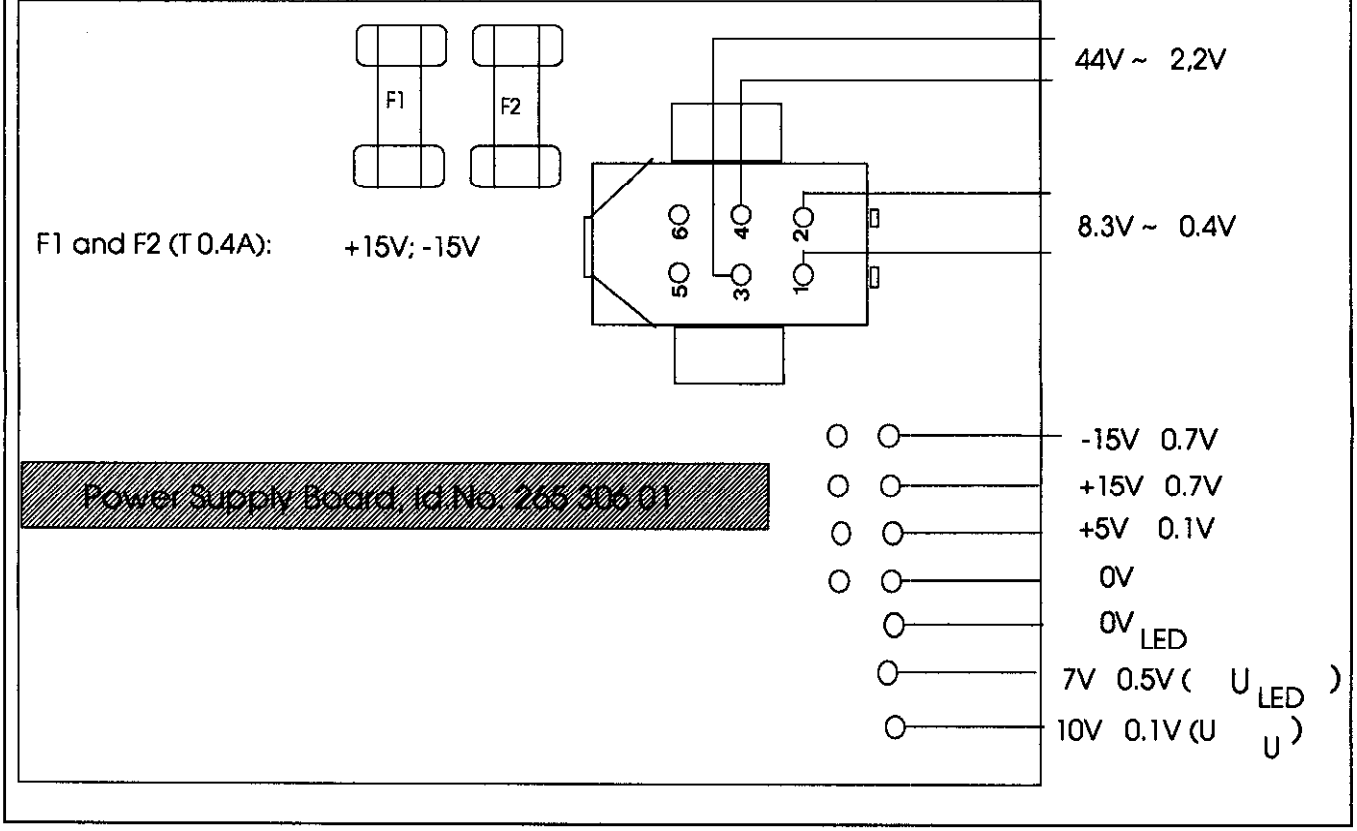

Gehäuse
Flanschdose BU 9pol. kompl.
X1
J2
X
X2
J3
Y
X3
J4
Z
G2
G3
G4
G1
G5
Platine, Analogteil-
P1
P2
X2
Kupplung BU 12pol. kompl.
Kabel-VB. flach 50xAWG 28 kompl.
X5 Platine, Anzeige-
Platine, Tastatur- 2x8
Platine, Tastatur- 8
Platine, Tastatur- 8
Flanschdose BU 22pol. kompl.
X45
P4
Platine, Analogausgang-
Trafo, Netz- kombi
XS1
Platine, Netzteil-
Stecker BU 4pol. kompl.
X3 P2
-15V
+15V
+5V
0V
LA7
LA6
LA5
LA4
LN1
LN2
LN3
TNC 113 Id.Nr. 216 130 10
TNC 113 Id.Nr. 216 130 13
TNC 113 Id.Nr. 216 130 15
TNC 113 Id.Nr. 216 130 23

4.5 Power Supply

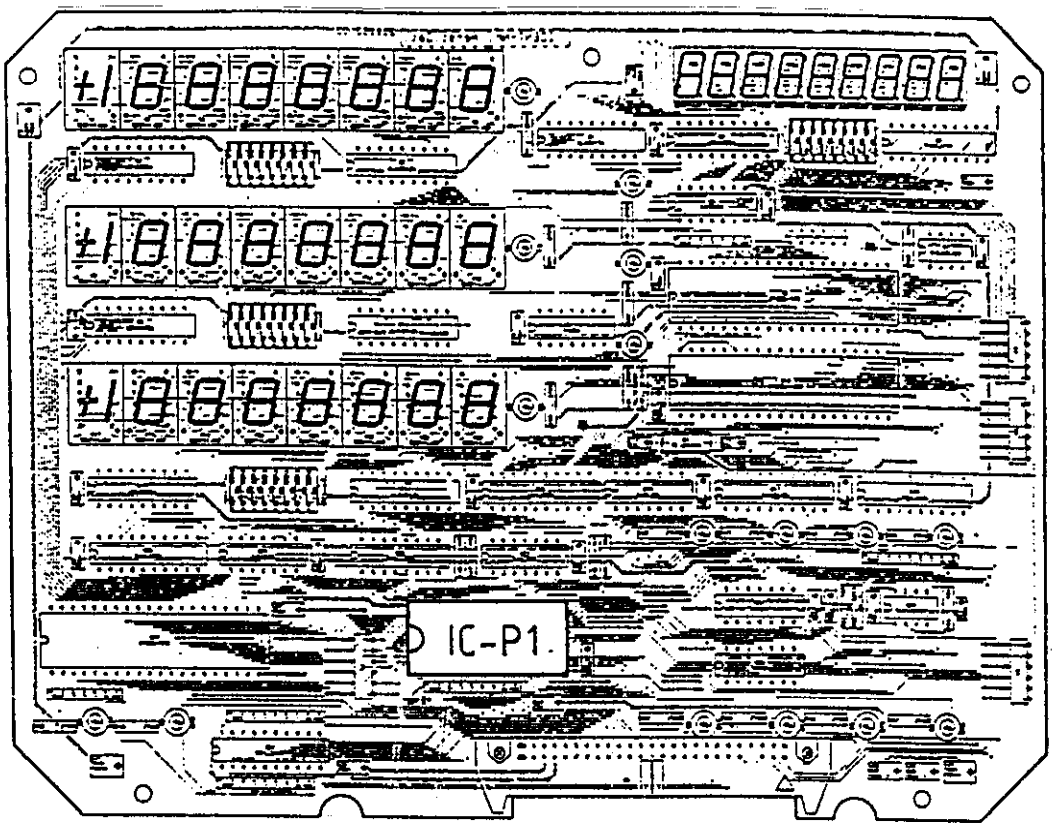


TNC 113 Id.No. 216 130 01
TNC 113 Id.No. 216 130 03
TNC 113 B Id.No. 233 205 01

TNC 113 Id.No. 216 130 10
TNC 113 Id.No. 216 130 13
TNC 113 Id.No. 216 130 15
TNC 113 Id.No. 216 130 23



4.6 NC Software



Display Board, Id.No. 216 333 01/ 264 372 01

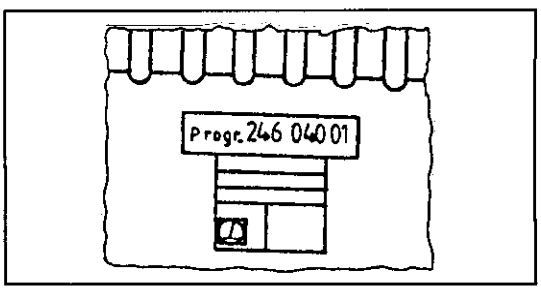
The operating program of the TNC 113 is stored in the EPROM **IC-P1** on the display board.

NC-Software Id.No. XXX XXX XX

NC-Software number XXX XXX

update index XX

e.g.

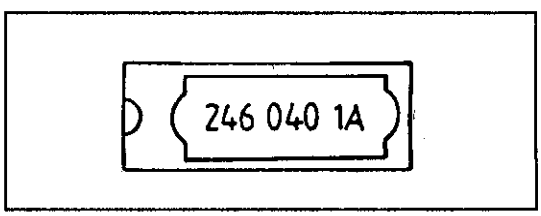


Id.No. of programmed EPROM XXX XXX XX

program number XXX XXX

update index XX

e.g.



4.7 Overview: Versions, Components, Software

Control Model	TNC 113	TNC 113	TNC 113 B	TNC 113	TNC 113	TNC 113	TNC 113	
Id.No.	216 130 01	216 130 03	233 205 01	216 130 10	216 130 13	216 130 15	216 130 23	
Housing	"old"	"old"	"old"	"new"	"new"	"new"	"new" +4 bore holes M5	
Encoder (grating period)	40µ	20µ	20µ	40µ/20µ	40µ/20µ	40µ/20µ	40µ/20µ	
Power Supply Board 219 096 01								
Power Supply Board 265 306 01								
Analog Board 212 627 01								
Analog Board 260 966 01								
Analog Output Board 215 847 01								
Analog Output Board 261 036 01								
Display Board 216 333 01								
Display Board 264 372 01								
NC-Software 212 916 ..								
NC-Software 246 040 ..								
NC-Software 246 088 ..								

Notizen

Notes